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NEEDLE MIDGE (DIPTERA:CECIDOMYIIDAE) DAMAGE TO LOBLOLLY PINES IN THE ERAMBERT FEDERAL SEED ORCHARD, MISSISSIPPI

U. S. FOREST SERVICE
Pineville, Louisiana

U. S. DEPARTMENT OF AGRICULTURE -- FOREST SERVICE
SOUTHEASTERN AREA, STATE AND PRIVATE FORESTRY
RESOURCE PROTECTION UNIT, FOREST INSECT AND DISEASE MANAGEMENT GROUP

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NEEDLE MIDGE (DIPTERA:CECIDOMYIIDAE) DAMAGE TO LOBLOLLY PINES IN THE ERAMBERT FEDERAL SEED ORCHARD, MISSISSIPPI

by

N. A. Overgaard[1/], H. N. Wallace[2/], C. Stein[2/], and G. D. Hertel[1/]

ABSTRACT

A midge, Contarinia *sp., causing needle droop and defoliation to loblolly pines was first discovered at the Erambert Federal Seed Orchard in Brooklyn, Mississippi, in 1971. Since severe dieback and defoliation associated with midge occurred in 1974, a 100 percent ground survey was conducted to determine the extent of the damage and the possible existence of certain clonal preferences. The survey showed 30 percent of the trees in the medium to heavy damage class in the south Mississippi loblolly geographical seed source, 17 percent in the Alabama loblolly seed source, and 5 percent in the north Mississippi loblolly seed source. A statistical analysis showed a definite feeding preference by the midge for certain clones. A study to determine larval feeding periods showed that the midge feeds May through August, with major feeding peaks in June and July.*

Midge populations increased from 1971 when Cygon® (dimethoate) was first applied until 1974 when severe defoliation occurred. Midge populations collapsed and the trees showed a complete recovery from the previous year's defoliation with the discontinued use of Cygon® during the 1975 season. Therefore, this insecticide is suspected as playing a role in causing midge outbreaks.

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INTRODUCTION

A midge, *Contarinia* sp.[3/], causing needle droop and defoliation to loblolly pine, *Pinus taeda* L., was first discovered at the Erambert Seed Orchard, National Forests in Mississippi, near Brooklyn, Mississippi in September 1971. Since that time, light to medium defoliation by this insect has occurred annually with symptoms appearing in August. This midge was also discovered feeding on loblolly pines at the International Paper Company's McNair Seed Orchard, McNair, Mississippi in October 1975.

The bright orange midge larvae (Fig. 1) feed underneath fascicle sheaths on tender young needles where they cause brown lesions and needle bending. The damaged areas then become visible when the needles elongate and grow out of the sheaths (Fig. 2). Larvae can be found by pulling out new growth needles from fascicles. When larval feeding damage is severe, needle drop occurs. As yet, we have not been able to rear out adults so a species identification has not been made.

Nothing is known about the biology, life history, or control of this needle midge. A midge, *Contarinia baeri* (Prell), introduced from Europe causes damage on Scotch pine, *P. sylvestris* L., in Canada similar to that caused by the *Contarinia* sp. found on Southern pines at the Erambert and McNair Orchards, Mississippi (DeBoo, et al., 1973). Canadians have conducted biological studies and small scale insecticide tests for *C. baeri* (Prell). Good protection of foliage was obtained with Cygon® (dimethoate), Baytex® (fenthion), and malathion. Best results were obtained when sprays were applied immediately after detection of the first larvae infesting the foliage. Correct timing of foliar pesticide applications was considered by the Canadians as a critical factor in achieving adequate control of the midge. Winter soil treatments with Temik® (aldicarb) granules apparently provided high mortality to adults emerging from ground litter.

Two other midges of the family Cecidomyiidae were identified from loblolly pine needles collected at the Erambert Orchard. One was a gall midge, probably *Janetiella* sp., and the other was a predator, *Lestodiplosis* sp.

3/ Identification by R. J. Gagne, Systematic Entomology Laboratory, A.R.S., Beltsville, Md.

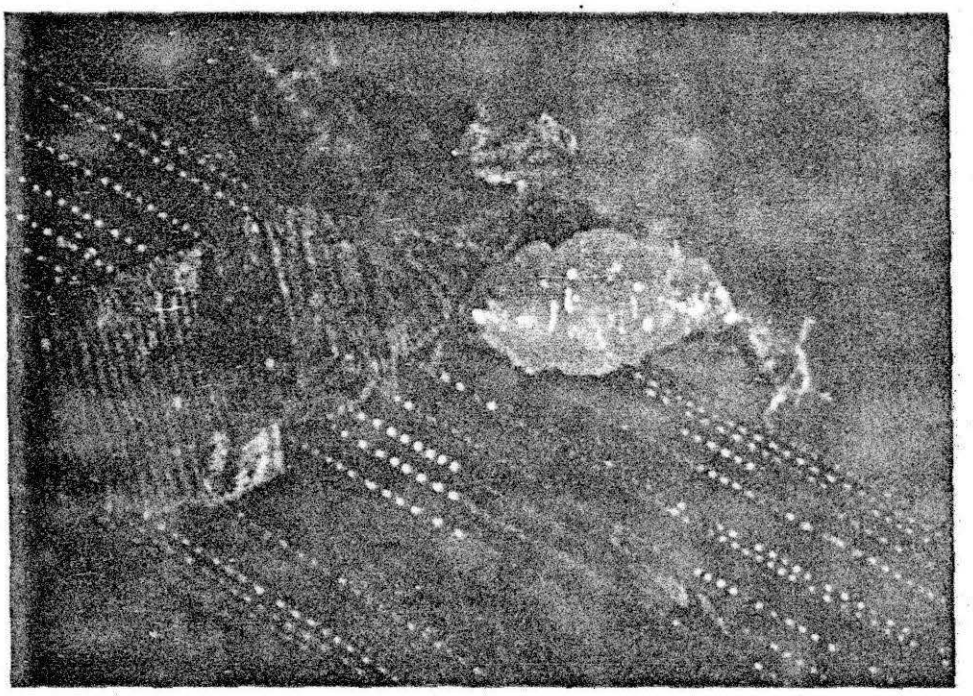

Figure 1. Larva of a needle midge, *Contarinia* sp.

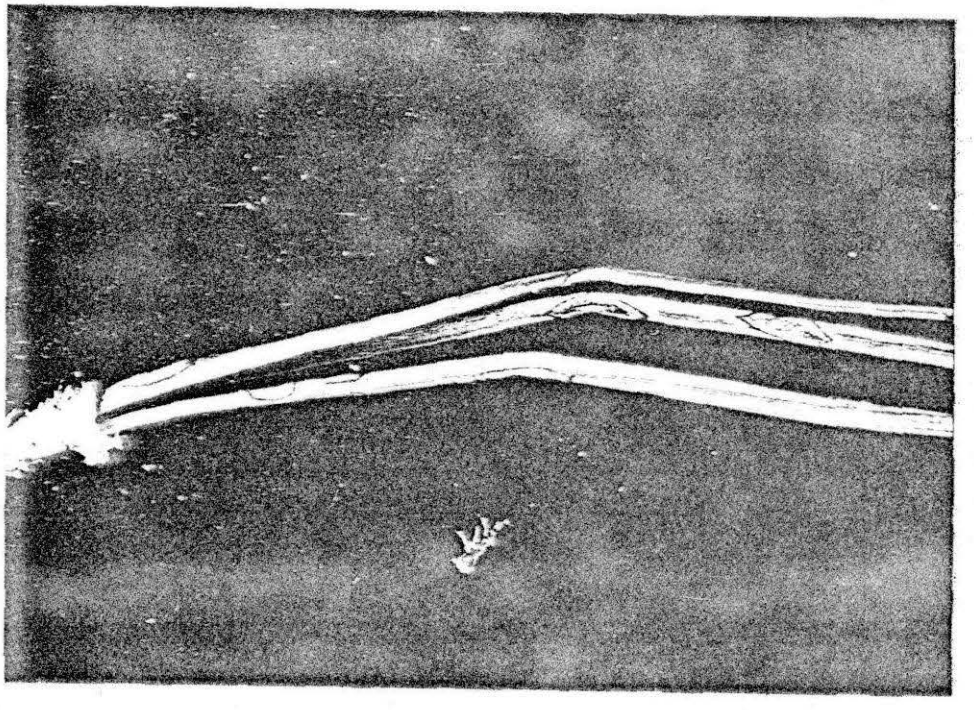

Figure 2. Damage to needles by a needle midge.

METHODS

Dieback and defoliation associated with midge attack of loblolly pines was most severe at the Erambert Orchard in 1974. For this reason, Resource Protection and orchard personnel conducted a 100 percent ground cruise survey on all loblolly pine geographical sources on December 3 to 5, 1974 to determine the extent of midge damage and the possible existence of clone susceptibility. Damage for each tree examined was categorized as none, light, medium, or heavy, using the following criteria:

None - No defoliation or evidence of midge damage.

Light - Light defoliation only. Slight damage to needles (Fig. 3).

Medium - Moderate defoliation with some denuding of terminal leaders. Considerable damage to needles.

Heavy - Heavy defoliation with terminal leaders completely denuded and often dying back from repeated defoliation. Considerable damage to needles (Fig. 4).

A chi square test was run on the data from the Southern Mississippi geographical source to test the hypothesis that no difference exists between clones with regard to the medium and heavy damage class.

Soil samples collected from under several midge-damaged trees were examined for the presence of overwintering midge larvae or pupae. Midge pupae were placed in rearing containers in order to obtain adult stages for taxonomic identification.

For the purpose of determining peak larval feeding periods of the midge, 30 shoots were collected at random each week during March through September 1975 from each of the northern Mississippi, southern Mississippi, and Alabama loblolly geographical sources. Ten of these shoots were examined microscopically for the presence of midge and midge damage. Five fascicles were removed from each 2.54 cm (1") of the current year's growth on each shoot. Numbers of fascicles containing midges were recorded.

Data from all sources were combined for determining the percentage of fascicles containing needle midge larvae each week. A portion of the larvae found were placed in containers with moist peat moss for rearing.

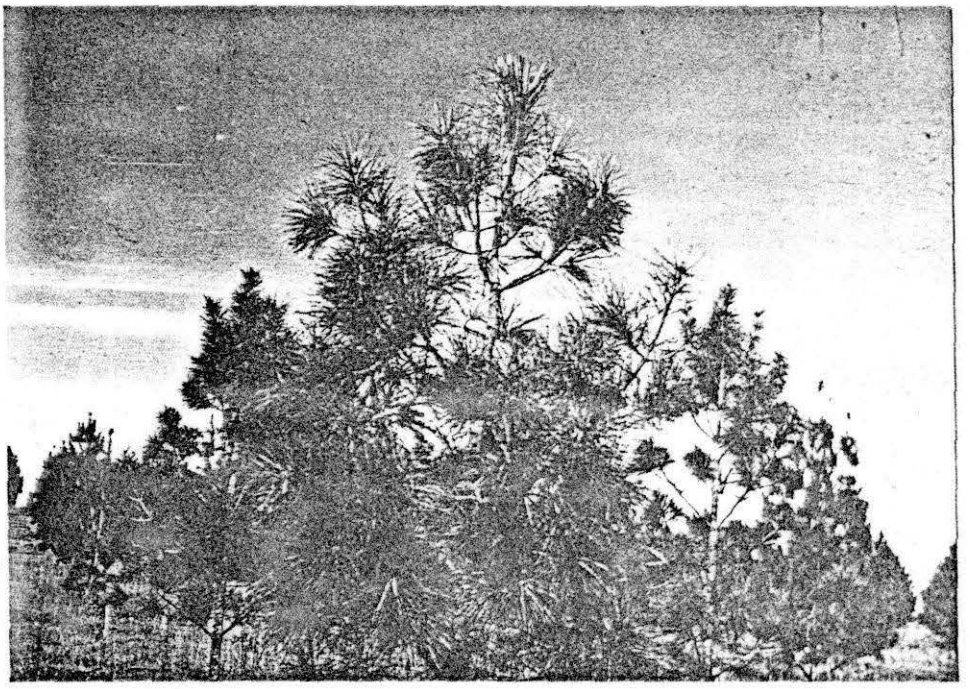

Figure 3. Light needle midge damage.

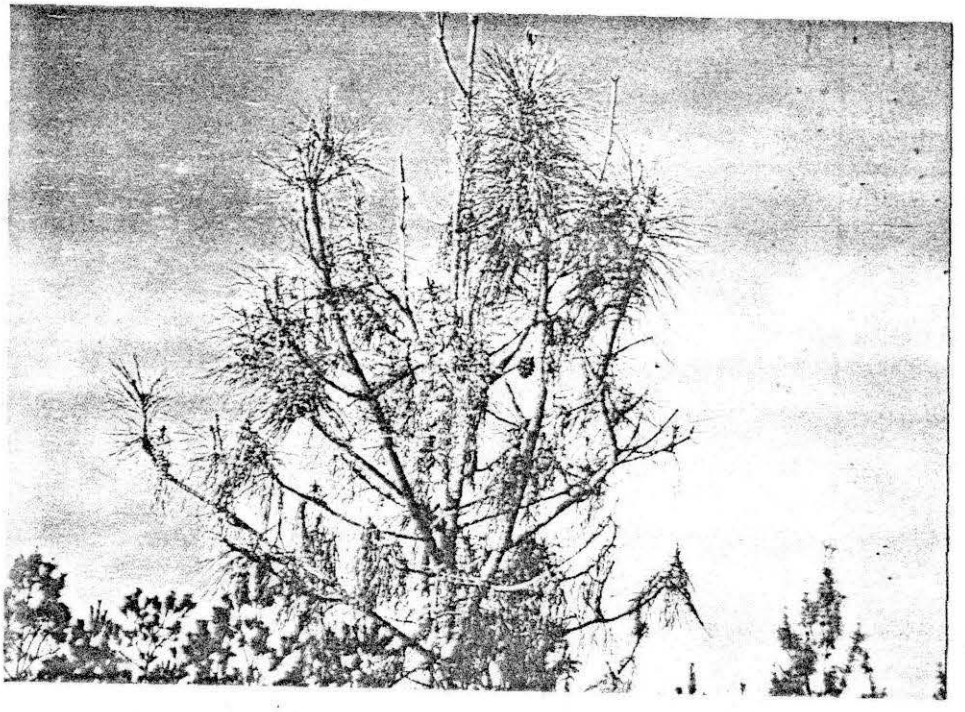

Figure 4. Heavy needle midge damage.

RESULTS

Results of the 1974 midge damage survey are summarized in Table 1. The heaviest damage occurred in the south Mississippi loblolly, the next heaviest in the Alabama loblolly, and the least in the north Mississippi loblolly (Fig. 5).

Table 1. Needle midge damage at the Erambert Orchard, December 1974.

Geographical Source	Percent of trees showing damage			
	None	Light	Medium	Heavy
South Mississippi Loblolly	5	65	24	6
Alabama Loblolly	11	72	14	3
North Mississippi Loblolly	46	50	4	0

The chi square test rejected the null hypothesis that there was no difference between clones with regard to the medium to heavy damage class in the southern Mississippi loblolly source; i.e., there was a difference between clones in this class; therefore, ranking of clones was justified. The ten most susceptible and the ten least susceptible clones are shown in Table 2. Clone 50 appeared to be the most susceptible clone, and clone 17 the most resistant clone. The other georgraphical seed sources showed similar trends with regards to clonal susceptibility; however, data was not analyzed statistically.

The midge feeding evaluation conducted March to September 1975 showed midge feeding occurring May through August with the first peak in May and two major peaks later - one the week beginning June 24 and one the week beginning July 21 (Fig. 6).

Attempts to rear midges to the adult stage have thus far been unsuccessful.

SUMMARY AND DISCUSSION

The needle midge, *Contarinia* sp. is evidently not a pest in natural stands of southern pines; however, local outbreaks at the Erambert Orchard in Mississippi have caused scattered light to heavy defoliation to loblolly pines since 1971, with some susceptible clones experiencing severe dieback associated with several years of defoliation.

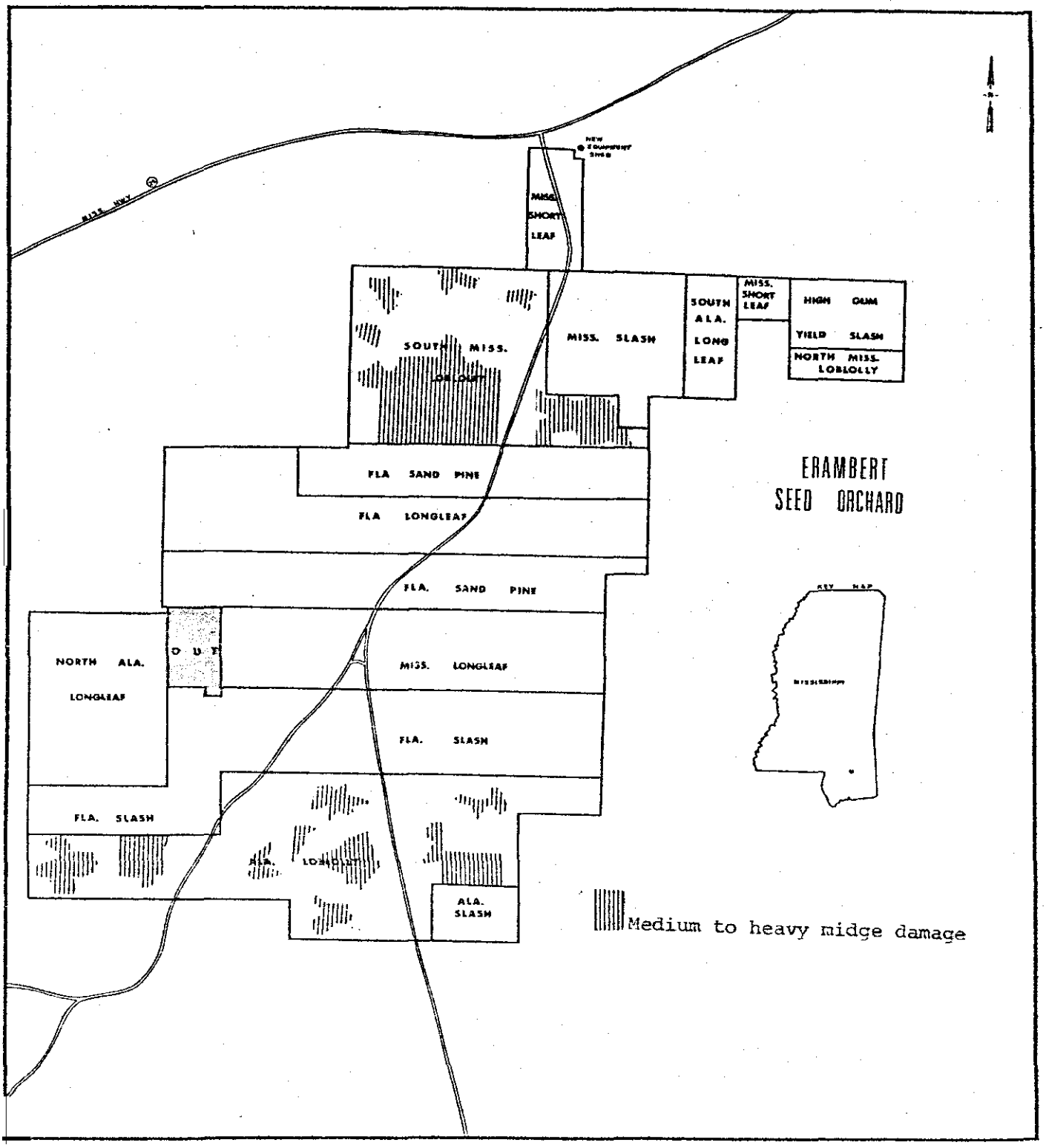

Figure 5.--Needle midge damage, *Contarinia* sp., at the Erambert Orchard showing areas of medium and heavy infestation.

Table 2. The clones most and least susceptible to medium-to-heavy damage of pine needle midge, *Contarinia* sp. (southern Mississippi loblolly geographical source, Erambert Seed Orchard, Mississippi, December 1974)

Ranking[1/]	Clone No.	% of ramets in each clone with medium to heavy midge-caused defoliation
1	50	69.1
2	28	61.4
3	37	51.9
4	35	51.3
5	32	51.2
6	49	48.7
7	13	47.4
8	26	45.6
9	27	45.6
10	47	40.5
41	38	15.8
42	31	15.4
43	15	14.3
44	22	13.4
45	18	13.1
46	9	11.8
47	44	11.4
48	7	11.2
49	41	8.9
50	17	6.0

1/ Ranked with the most susceptible clone first.

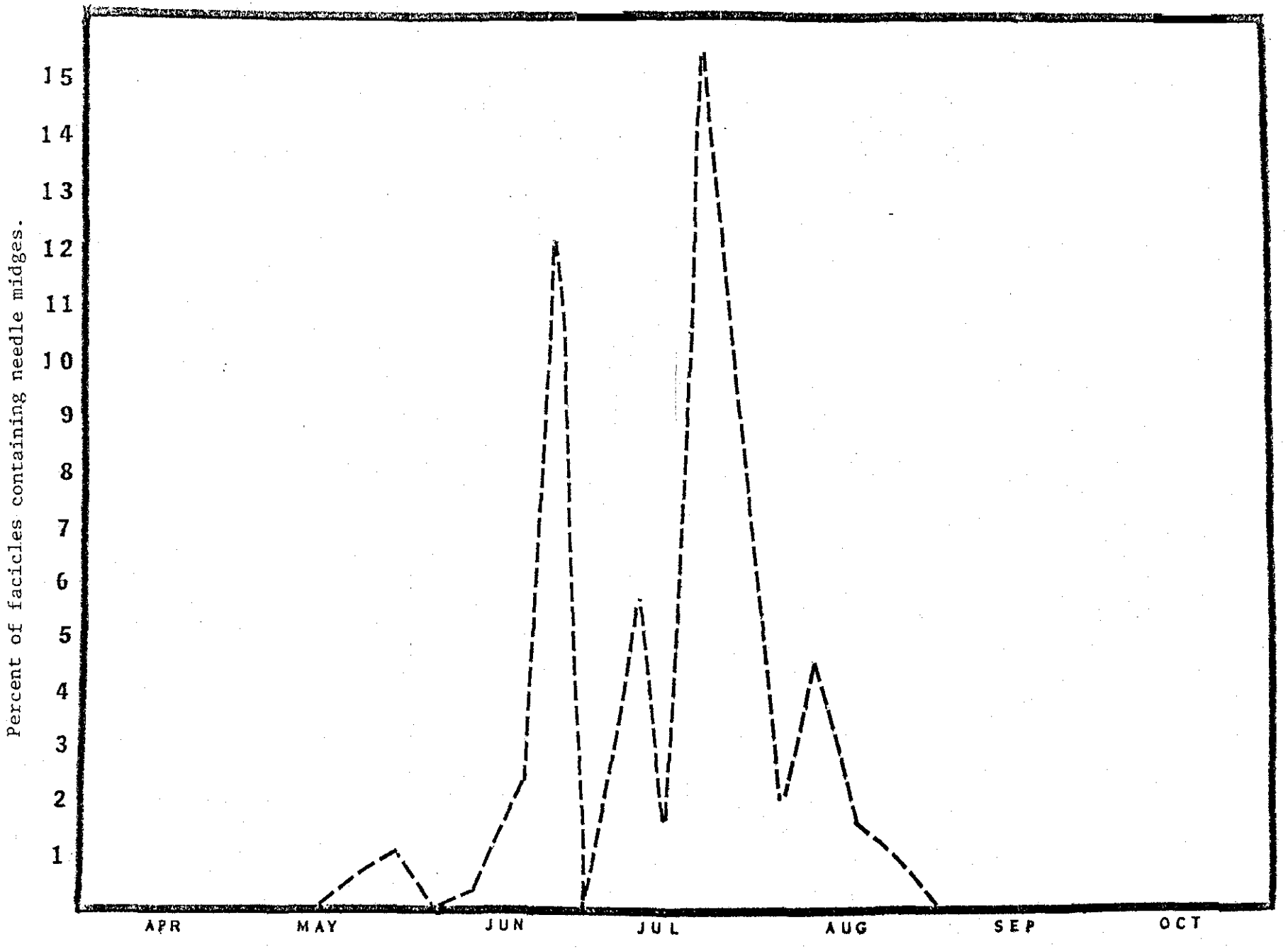

Figure 6. Active midge, *Contarinia* sp., feeding on loblolly pine at the Erambert Orchard, Mississippi 1975

During 1971-74, Cygon® 1.9 l/380 l or 4 pints of 2#/gal e.c./100 gal H_2O was applied as a drench spray three to five times annually, (March-September) for tip moth control on shortleaf and loblolly pines at the Orchard. Sprays were discontinued on loblolly pines during 1975 because they were considered a possible factor in causing the midge to become epidemic.

With discontinued use of Cygon®, loblolly pines, including those heavily damaged, made a complete recovery (Dugar et al. 1976). This fact suggests that this insecticide might play a role in causing the midge to become epidemic. Buildup of needle midge populations have been reported on loblolly pines at the McNair Orchard, located near Natchez, Mississippi, after several years of spraying Guthion® for coneworm control. This fact suggests Guthion® may also be implicated. When needle midges become a problem as a result of use of these insecticides, their use may have to be discontinued.

Drs. Powers and Matthews of the Southeastern Forest Experiment Station have recently cultured fungi of the genus *Fusarium* from branch damage associated with midge infestation at the McNair and Erambert Orchards. Isolated fungi were sent to the University of Pennsylvania for identification. Several fungi were identified from the isolates and *F. moniliforme* was the most prevalent fungus found. Inoculations of the above-isolated fungi have been made on slash pines and rapid dieback of branch tips of inoculated plants has been observed. The test is to be repeated on loblolly pines. The above scientists have developed the working hypothesis that the dieback at the McNair Orchard is related to a fungus carried by an insect vector, with the needle midge, *Contarinia* sp., suspected as being the vector (personal communication).

RECOMMENDATIONS

1. Attempts to rear larvae to the adult stage for purposes of species identification should continue.

2. Personnel from Southeastern Forest Experiment Station, Athens, Georgia; Mississippi State University; and State and Private Forestry, Alexandria Field Office should conduct a field trip to the McNair and Erambert Orchards during July or August 1976 to look over the midge situation.

3. The life history, biology, impact on the host, and factors which cause the midge to become epidemic should be researched. Mississippi State University indicates they may have a graduate student interested in doing this work.

4. When the above information is obtained, insecticide screening and field tests should be conducted. Susceptible clones should be used for field tests.

ACKNOWLEDGEMENTS

We would like to thank Dr. Tom Lloyd, Statistician, Southeastern Forest Experiment Station, for assistance with the clonal susceptibility evaluation, and the Erambert Seed Orchard personnel for collection of the needle samples during the summer of 1975.

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Dugar, P. A., M. J. Weiss, P. Peacher, J. F. Wolfe, N. A. Overgaard, and R. Loomis. 1976. Dieback survey of the Erambert Seed Orchard. (In preparation).